

Self-Directed Learning with ICT:

Theory, Practice
and Assessment

Tan Seng Chee
Shanti Divaharan
Lynde Tan
Cheah Horn Mun



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Ministry of Education
Educational Technology Division
1 North Buona Vista Drive
Singapore 138675

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Preface

This monograph about Self-Directed Learning (SDL) is written with the Singapore educational context in mind, particularly within the context of formal schooling. It also explores the use of information and communication technologies (ICT) when promoting SDL in different learning scenarios. As former teachers in Singapore, we are mindful of the teacher's needs and responsibilities. Hence, the main audience of this book is teachers from primary schools to junior colleges. As educators in our different capacities, we hope that teachers in Singapore have a better idea of what it means to promote SDL as a 21st century skill in schools. Our intent is to use this book as a catalyst to more fruitful conversations on promoting SDL among our learners in Singapore.

CONTENTS

Preface	1
Table of Contents	2
List of Tables	3
List of Figures	4
Introduction	5
Chapter 1: Self-Directed Learning – A Natural Process of Learning	8
Chapter 2: Principles for Designing SDL	19
Chapter 3: Worked examples of SDL	28
Chapter 4: Assessment and SDL	44
Concluding thoughts	59
References	60

LIST of TABLES

Table 1	Possible behavioural indicators of the salient aspects of SDL	16
Table 2	Students' self-assessment of SDL behaviours	48
Table 3	An example of an assessment rubric for a science project	50
Table 4	Assessing students' SDL behaviours	54
Table 5	Teachers' self-assessment of scaffolding for SDL	56

LIST of FIGURES

Figure 1	SDL spectrum and student's readiness	20
Figure 2	Design principles for SDL	21
Figure 3	Key processes of a learning portfolio	53

Introduction

The world that we live in today is a knowledge society. According to United Nations Educational, Scientific and Cultural Organization (Bindé, 2005), otherwise known as UNESCO, a knowledge society values creation and sharing of new knowledge, so that the new knowledge can be applied for the well-being of its people and solutions to global problems such as poverty and environmental damage. The health and wealth of a nation are now dependent on what is commonly known as knowledge workers, that is, workers who are able, flexible, creative, confident, good team players and are able to solve new problems; the most efficient production workers who can only follow standard procedures do not fit the bill in today's world.

To put it differently, the social and cultural characteristics of a knowledge society require citizens to be highly adaptive. Our societies today are fast-changing, multi-cultural, multi-racial and multi-religious, which can be attributed to high mobility and connectivity amongst people. In addition, the rapid development in social media such as Facebook and blogs helps to promote social interactions amongst people, breaking the boundaries of time and space. As a result, many modern societies are becoming global villages. Constantly learning about the diverse cultures, beliefs, languages, and customs of the people we meet is essential. Interactive and social media are also empowering people towards self-actualisation that is characterised by greater autonomy and lifelong learning. To develop our students as confident citizens in today's knowledge society means that access to education, the capacity to learn, a disposition for lifelong learning, competencies in communication and collaboration in knowledge

creation activities are becoming increasingly important for participation in a socially and culturally diverse world.

It can be argued that the demands of globalisation necessitate the need for our students to become more conscious, controlled, independent and active in their learning. This way of learning enables our students to adapt to the ever-changing situations in our work lives, personal lives and social lives in the knowledge society. It is therefore no longer sufficient to help our students achieve only the learning objectives specified in the national syllabi. Rather, learning needs to be broadened to develop students' competencies in learning how to learn; this may include the ability to identify, manage and mobilise resources for learning and the ability to monitor their own progress in learning. We need to foster amongst our students an acute sense of inquiry so that they are intrinsically motivated to understand things surrounding them. In this way, we will develop learners who learn actively while they are studying in a formal institution, and seize every opportunity to engage themselves in lifelong learning.

Needless to say, technology is indispensable in our globalised world. Developing students' competencies in using information and communication technologies (ICT) is vital to their participation in the knowledge society. Many education departments or ministries in more developed countries have charted roadmaps that aim to develop ICT skills that prepare students with the necessary skills, knowledge and dispositions to become confident citizens in the globalised world (Plomp, Anderson, Law, & Quale, 2009). Countries like Finland, Hong Kong, Singapore, the United Kingdom, and the United States have been implementing nation-wide policies on the use of ICT in education; in fact, many of them are into their second or third nation-wide ICT master plans. This concern is shared by Singapore, which anchors its ICT masterplans in the philosophy that "education should continually anticipate the future needs of society and work towards fulfilling these needs" (Ministry of Education, 2002, p. 1). In the current third ICT masterplan in Singapore, it is stated that the Education Ministry aims to develop

each of our Singapore students into “a self-directed learner who takes responsibility for his own learning, who questions, reflects and perseveres in the pursuit of learning” through the use of ICT (Ministry of Education, 2009, p. 1).

Bearing in mind the demands of globalisation in the knowledge society and with the aim to support the Singapore Education Ministry’s goal of developing self-directed learners through the use of ICT, we purport to unpack the notion of self-directed learning (SDL) that is culturally appropriate for our Singapore context. In chapter 1, we first present an overview of the differing notions of SDL in literature from various disciplines and examine the processes that are commonly entailed in this way of learning. We then move on to chapter 2 where we aim to present the extent SDL can take place in educational scenarios that are familiar to our local teachers. In the same chapter, we also make explicit the principles that are necessary considerations for classroom teachers who intend to design SDL in their instructional approaches. In chapter 3, we succinctly present examples to illuminate our ideas of how SDL can be actualised in our Singapore context. In this chapter, we also emphasise the affordances of some technological tools that can possibly support SDL. Through the examples, we hope that teachers can envision how they can support SDL as they implement the third ICT Masterplan in their teaching and learning. We move on to discuss assessment issues pertaining to SDL in chapter 4. We examine ways of assessing SDL with examples of rubrics that teachers will appreciate when considering ways of developing students’ capacity in self-assessment and guiding students when they self-direct their learning. Chapter 5 summarises our concluding thoughts on fostering SDL in the context of our formal schooling in Singapore.

1 Self-Directed Learning (SDL) – A Natural Process of Learning

Introduction

In our introduction, we stress the urgency in looking beyond immediate learning goals in schools to prepare our students to thrive in a knowledge society that is globalised and diverse socially and culturally. It has been widely acknowledged that the purpose of education is no longer simply producing manpower to fill the existing job vacancies, but anticipating the needs of future and preparing for jobs that are yet to be created in the new economy (Koh & Lee, 2008). In this chapter, we explore the differing notions of SDL and identify a feasible notion that is relevant to Singapore. We contend that SDL is a critical life skill for today's young people. It enables a person to be highly adaptive to new situations and environments, to gather resources and learn quickly so as to solve new problems or handle new jobs or situations they encounter.

SDL is a process that occurs naturally for everyone (Gibbons, 2002). Take the study conducted by Md Nor and Saeednia (2009) as an example. They argue that children as young as nine years of age are capable of self-directing their learning. In their study, they reported that the children were able to demonstrate differing extents of self-discipline, curiosity, independence, persistence, goal orientation, responsibility, and enjoyment in their learning. Drawing on our daily lives, it is common to observe some of these traits in young children. Children can be so curious in their world that it is not surprising to see how they find ways to learn something new to them, be it a fallen leaf on a road or a rubber door wedge; they will use all their senses to explore the new object. Take the following vignette for

an example. It illustrates how a one-year-old baby learnt to use a straw to drink water from a cup.

Vignette: SDL is a natural process of learning developed from a young age

Grace just turned one. Her mother bought her a cute little baby cup which came with a straw that was attached to the lid. Prior to this, she had been drinking from milk bottles with silicone teats. She was curious about the cup; she shook it and chuckled at the noise the water made. At first, she used the same method of drinking from a milk bottle - biting the straw, treating it like a teat and tilting the cup up to drink the water. Failing to drink the water, she played with it like a toy. One day, Grace sat next to a girl who used a similar cup to drink some water. She observed the girl intensively for a while. She must have realized that she could drink water from the cup, but not in the same way as drinking it from a milk bottle. Later that day when she was at home, she was observed sucking the straw from her cup in the same way as the older girl she observed. It took her a few attempts before she got it right. She was so thrilled that she drank up all the water in the cup.

The point we are making here is this: We learn not just in schools but also in our everyday lives and our learning endeavours develop naturally from the experience that we draw on. Amongst young people and adults, SDL is also prevalent. Take for an example, after buying any new technological gadget, we learn how to use the gadget and its applications in multiple ways. Some prefer to learn by exploring the applications through trial and errors while others prefer to read the manual or search for tips on the YouTube and other websites. Other examples of SDL in our everyday lives that are familiar to many of us include filling in a web-based tax return form, driving to a new shopping mall, knowing the best spot to park at the new shopping mall, or learning how to operate a new camera.

If SDL is intuitive and natural as some have argued (Gibbons, 2002), why is it worthy to study it as a special field of work on its own? What can a deeper understanding of SDL offer teachers who are interested in improving their practices in the context of formal schooling? We begin addressing these questions by first reviewing the historical development of SDL that has its roots in adult education.

Historical Development of SDL

It was in the early 20th century that SDL was systematically studied, partly due to the development in the field of adult learning. Adult education was recognised as a professional field of practice in the 1920s. Prior to this, much of the research on adult learning in this period was modelled after how children learnt. The researchers and practitioners felt a need to differentiate the ways children and adults learnt. This quest for differentiation thus gave rise to the development of two theories (Merriam, 2001) - andragogy and SDL - which we shall elaborate below.

Theories of adult learning as a distinctive field has been widely developed in Europe to identify educational needs for adults before Malcolm Knowles (1980) popularised the term, andragogy, in the United States in the 1960s. According to Knowles (1980), andragogy is “the art and science of helping adults learn” (p.43) and it is distinctive from pre-adult schooling. According to Merriam, Mott and Lee (1996), there are some salient assumptions about the learner pertaining to andragogy, namely, the learner

- is accountable for his or her learning
- has accumulated vast experiences that provide the foundation for learning
- has learning needs that are related to social changes and the learning needs are problem-centred and create opportunities for immediate application
- engages in learning that is internally motivated

Later in the 20th century, researchers began to question whether andragogy, as described by Knowles (1980), was truly unique to the adult learners. For example, Hanson (1996) argued that the characteristics of an adult learner were also found amongst children. Like adults, children could possess intrinsic motivation to learn. If the problem was of interest to the child, he or she would make attempts to address the need for knowledge in order to solve the problem. In fact, in certain situations, children's experiences were richer than adults and these experiences provided the relevant foundation to their learning (Hanson, 1996). This then alerts us to the fact that learning should not only focus on the maturity of the learner but also on the situation in which learning occurs. For example, some adult learners may require their teachers to structure their learning while some children fare better if they are given opportunities to direct their learning. What these studies point to is the argument that SDL seems to be dependent on the readiness of a learner, the content and the context of learning, rather than on the age of the learner.

Parallel to the development of andragogy in the European continents in the 20th century, SDL emerged in the United States as a formal field of study to help comprehend how adults learnt. Tough (1967,1971) conducted the pioneering work on SDL and found that typically an adult spent around 500 hours a year on intentional learning projects outside formal education. Since then, researchers have focused on the instructional design for adult learners by analysing the learner, identifying relevant resources, selecting instructional formats and evaluating learning outcomes.

Starting from the 1980s, researchers have begun to focus more on the learning processes, namely the learner characteristics, the learning context and the nature of learning itself. A well-known example is Grow's (1991, 1994) Staged Self-Directed Learning model (SSDL). The matrix presented in this model enables learners to identify their stage of readiness for SDL. The teachers then provide

the appropriate scaffolds and learning guidance based on the learner's needs to help them to learn effectively.

SDL as a 21st Century Skill

Interestingly, as we crossed into the new millennium, a number of reports on K-12 education – such as “enGauge@21st Century Skills: Literacy in the Digital Age” (North Central Regional Educational Laboratory, 2003) and “Results that matter: 21st Century skills and high school reform” (Partnership for 21st Century Skills, 2006) – began to question the adequacy of school education in preparing students for new challenges in the twenty-first century, which culminated into recommendations for 21st Century skills amongst our students. SDL is listed as a key component of the 21st Century skills. SDL is also intricately linked to lifelong learning, which has been listed as a demand for modern society by international organizations such as UNESCO and OECD. Concomitantly, there is increased research activity on self-direction amongst K-12 students. In short, self-direction is now recognised as an important 21st Century skill for our learners.

Amongst these diverse perspectives of SDL, we find the definition proffered by Gibbons (2002) most useful for our formal education in Singapore. According to Gibbons (2002), SDL is “any increase in knowledge, skill, accomplishment, or personal development that an individual selects and brings about by his or her own efforts using any method in any circumstances at any time” (p.2). Gibbons’ (2002) notion of SDL stresses the importance of developing ownership of learning as it will motivate a learner to pursue a learning goal and persist in the learning process. Based on his perspective, SDL involves initiating personally challenging activities and developing personal knowledge and skills to pursue the challenges successfully. This notion of SDL resonates with what our Singapore Education Ministry aims to achieve through the third ICT masterplan. Specifically, we think it leads to three important aspects entailed in self-directed

learning: (a) ownership of learning; (b) self-management and self-monitoring; as well as (c) extension of learning.

Ownership of learning

The learner's characteristics or personal attributes are important to SDL, particularly possessing personal responsibility in learning. Brockett and Hiemstra (1991) argue that personal responsibility is the "cornerstone of self-direction in learning" (p. 27). Learners who take personal responsibility in learning have ownership of their learning, set learning goals, and accept the consequences of their thoughts and actions. Candy (1991) suggests that developing personal responsibility in SDL can take place within an institutional setting such as a school; learners are capable of developing personal autonomy or certain amount of control in making decisions about their own learning.

Developing a sense of ownership of learning is closely related to the motivation to learn. According to Garrison (1997), there is a difference between entering motivation and task motivation. Entering motivation refers to how much the learner is attracted and committed to the learning goal. This is affected by various factors, for example, whether the learning goals will meet the learners' needs, whether they perceive the goals as achievable, and how they perceive their own self-efficacy in relation to the goals. Providing opportunities and control for learners to set their learning goals can enhance their entering motivation. While entering motivation affects a learner's choice of learning goals, task motivation affects the learner's sustaining effort towards the learning goal. It is affected by extrinsic rewards and more importantly, the intrinsic motivation to work on a task. Thus, it is important to provide opportunities for learner's control in managing and monitoring their learning, and help develop their capacity in this aspect.

Learner's motivation is jointly shaped by personal attributes and external contextual factors surrounding the learners. For example, a learner who experiences supportive learning environment that leads to their success in the past is likely to expect similar success in future, and will have higher entering motivation towards similar learning goals. This interaction between internal and external factors is even more evident in the management and monitoring of learning process.

Self-management and self-monitoring

Brockett and Hiemstra (1991) view SDL as an instructional process of assessing learners' needs, identifying learning resources, implementing learning activities and evaluating learning outcomes. It focuses on teaching-learning transaction in an institutional setting that is almost akin to individualised instruction. It involves negotiation between the learners and the teacher about the learning goals, methods of learning, use of resources, and assessment of outcomes. Candy (1991) and Garrison (1997) use the term self-management to describe this aspect of behavioural task control relating to management of learning activities. In addition, they propose an internal cognitive dimension that relates to learner's thinking and monitoring of learning, which is termed self-monitoring by Garrison. It is important to note that self-management is characterised by management of external tasks and resources, whereas self-monitoring involves internal process of thinking, reflection, and making improvement on the learning process.

Self-monitoring focuses on both cognitive and metacognitive aspects of learning, which are internal to the learners. Cognitive processes (e.g., thinking, making meaning of the information, and integrating new knowledge into existing knowledge structure) are necessary in all learning processes. Metacognition refers to thinking about thinking or learning to learn, which is related to learner's ability to reflect on their learning. This aspect of SDL is close to self-regulated

learning (Bandura, 1986; Zimmerman, 1989). For example, Bandura (1986) suggests regulating one's learning by self-observing, self-judging and self-reacting to the learning tasks and performance. Even though self-monitoring involves internal cognitive processes, external factors such as feedback from the teacher or others can influence a learner's reflection.

Extension of learning

While Brockett and Hiemstra (1991) focus on SDL in institutional setting and acknowledge the influence of external contextual factors (e.g. the structuring of learning activities and availability of resources) in this learning process, Candy (1991) extends the idea of SDL from an instructional setting to an informal, non-institutional, everyday setting, which he called the autodidactic domain. Autodidaxy literally means self-teaching, where a learner has total control about the choice of what to learn, where to learn, how to learn, and how to evaluate learning. An example is to learn about iPhone applications by reading the manual or searching for online instructions, which we described in our introduction of this monograph.

Behavioural Indicators for SDL

It is important for teachers to recognise what SDL looks like in order for teachers to encourage SDL amongst their students. The theoretical ideas on the ownership of learning, self-management and self-monitoring and extensions of learning are more useful when they are translated into possible observable indicators for classroom uses, even though we acknowledge that SDL cannot be naively narrowed down to a laundry list. With the use of behavioural indicators, teachers can monitor whether their students are engaged in SDL and this may serve as useful information when planning instructional strategies. It is important to note that behavioural indicators are never exhaustive and they are not capable of capturing the internal (meta)cognitive processes of the learners. To probe

deeper into students' thinking, teachers have to rely on other methods such as think-aloud protocols or reflection logs. Table 1 below shows some possible behavioural indicators of the three salient aspects of SDL.

Table 1: Possible behavioural indicators of the salient aspects of SDL

Salient aspects of SDL	Some possible behavioural indicators
Ownership of learning	<ul style="list-style-type: none"> • Students identify, determine and articulate their own learning goals • Students identify learning tasks to achieve the goals • Students chart their learning processes • Students challenge themselves and set the standards for the achievement of their learning goals
Management and monitoring of own learning	<ul style="list-style-type: none"> • Students formulate questions and generate relevant inquiries • Students explore a range of possibilities and make sound decisions • Students self-plan and self-manage their time • Students critically reflect on their learning and initiate gathering of feedback from teachers and peers to achieve their learning goal
Extension of own learning	<ul style="list-style-type: none"> • Students apply what they have learnt to new contexts • Students utilise the skills that they have acquired to learn beyond the curriculum contents

In short, these behavioural indicators point to students' maximum control over their own learning experience. As they chart their own learning, skills are inevitably developed as they rise to meet the challenges they set for themselves. Needless to say, the extents of such behaviours differ according to the extents of participation in SDL.

Additional Notes about SDL

SDL may appear antithetical to collaborative learning and it seems paradoxical to relate the two. However, it is evident that even when learners exercise internal metacognitive process, external factors like teacher's and peers' feedback can be used as a resource for the reflective self-regulating process. In a collaborative learning setting, learner-learner interaction provides opportunities for learners to subject their view to public scrutiny and query, and they engage in processes of negotiation or debate, and acquire deeper understanding of the topic being studied.

In fact, the principles of collaborative learning (Johnson & Johnson, 2000) include both positive interdependence amongst the group members, and also individual accountability and responsibility to achieve the group goals. A good example is Horace Mann Magnet Middle School in Arkansas in the United States that used environmental and spatial technologies to engage their students in SDL that not only developed these students collaborative and other 21st century skills in their service learning projects (eduTopia, 2007).

While the ultimate goal of SDL is autodidaxy (self-teaching), teachers play the critical role of motivating students to initiate learning challenges and helping them to develop their competency in managing and monitoring their learning. To foster SDL, it may not be appropriate to set a highly structured learning task and ask students to faithfully execute the task. Conversely, setting a topic for students to conduct their independent research or to do a project work may not be appropriate for students who are not ready. On one hand, when there is too much control, it will take much effort to develop sense of ownership of learning. On the other hand, the students may not be ready for independent learning. They may resort to various coping mechanisms to complete the assignment rather than engaging in SDL. In the formative years of education, designing for SDL is like flying a kite. The teacher needs to leverage the wind speed to fly the kite

high, yet maintain just sufficient pull and tug to steer the kite in the right direction. Student's readiness is an important factor to consider. In the next few chapters, we will discuss roles of teachers in fostering SDL amongst their students.

2 Principles for Designing SDL

SDL as a Spectrum

In Chapter 1, we pointed out that in today's globalised world, SDL is widely recognised as an essential 21st century skill. We also debunked the myth that SDL can only take place amongst the adults. It also does not necessarily have to take place in formal educational institutions. For instance, literature in literacy research increasingly has provided ethnographic accounts of how young people have been participating in SDL in technology-mediated environments outside schools (Ito, et al., 2008; Sefton-Green, 2004). In this chapter, we stress on the importance of teachers' capability of providing opportunities for SDL to be fostered amongst their students, especially in the context of formal schooling. With relevance to Singapore context, the paramount question to ask is this: How can the principles of SDL be implemented in Singapore classrooms when the skills and knowledge to be learnt are highly structured in the national curricula?

Gibbons (2002) believes that SDL take place as a spectrum. According to Gibbons (2002), there are various phases in SDL and these phases start as a low degree of self-direction to the highest degree of SDL:

1. Incidental self-directed learning: The occasional introduction of SDL activities into courses or programs that are otherwise teacher-directed.
2. Teaching students to think independently: Courses or programs that emphasise the personal pursuit of meaning through exploration, inquiry, problem solving and creative activity.

3. Self-managed learning: Courses or programs presented through learning guides that students complete independently.
4. Self-planned learning: Courses or programs in which students pursue course outcomes through activities they design themselves.
5. Self-directed learning: Courses or programs in which students choose the outcomes, design their own activities and pursue them in their own way.

Nonetheless, we do not think that these phases necessarily take place in a hierarchical and neat order in practice. Figure 1 summarises Gibbon's spectrum that is matched with the three aspects of SDL discussed in Chapter 1.

Phases of SDL (Gibbons, 2002)	Student's readiness	Student's SDL characteristics		
		Ownership	Monitoring and Management	Extension of learning
Self-directed learning	High	High ownership, identify and commit to learning goals	Skilful in managing and monitoring own progress of learning	Extend learning beyond school's curriculum
Self-planned learning				
Self-managed learning				
Teaching students to think independently				
Incidental self-directed learning	Low	Low ownership, dependent on teachers to direct learning	Unable to manage and monitor learning	Learning is limited to resources provided in classrooms

Figure 1: SDL spectrum and student's readiness

Where Does a Teacher Begin?

Before a teacher considers the changes needed in order for SDL to take place in his or her classroom, the first thing he or she has to do is to make a conscious decision that he or she indeed wants SDL for his or her students. Once the teacher has made up that decision, it is advisable for the teacher to ask himself or herself the following questions:

- Which phase of SDL am I ready to implement?
- Which phase of SDL are my students ready for?

The following are some assumptions made before implementing SDL:

1. Students are capable of being self-directed learners.
2. SDL is both an outcome and a process.
3. Technology by itself does not promote SDL; rather it supports or enhances the learning process.

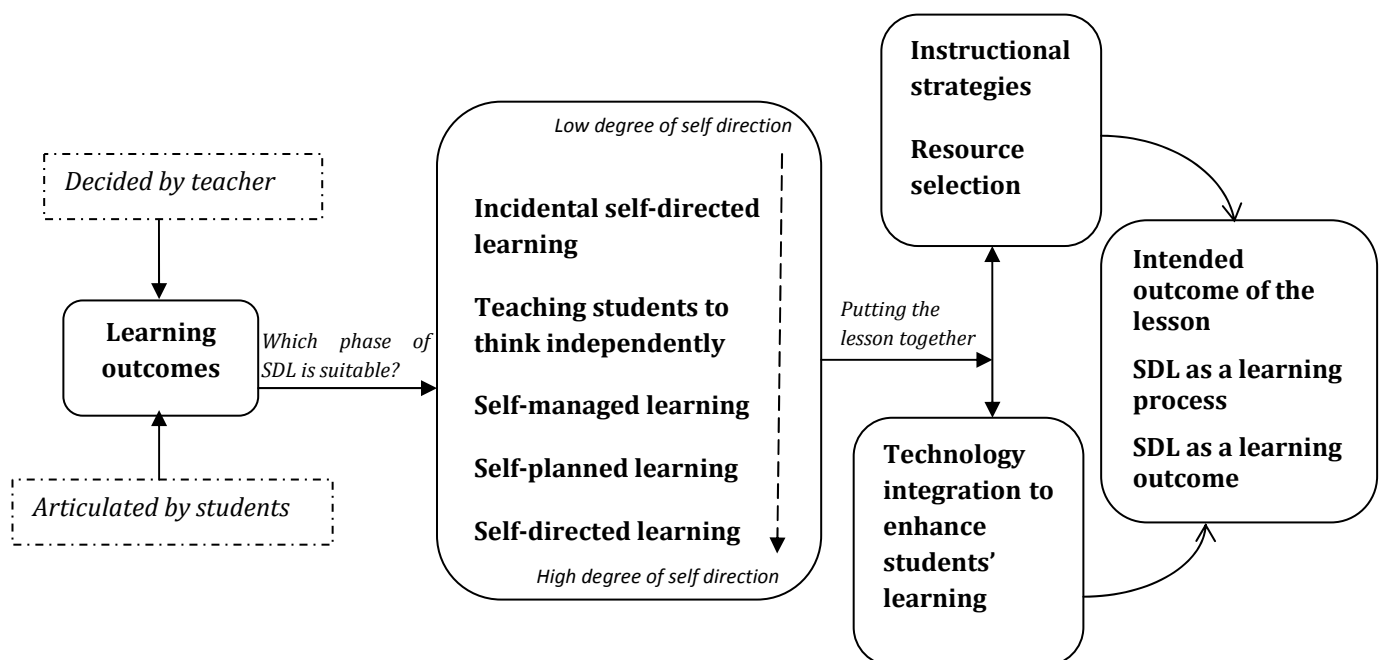


Figure 2: Design principles for SDL

Having made the decision to implement SDL, there are some design principles for the teacher's consideration. Figure 2 gives an overview of the design principles that a teacher would have to think through.

Learning outcomes

From the diagram above, the first important aspect in planning an SDL lesson (for the matter, any lesson) is to decide what the learning outcome is. Learning outcomes can be either decided by the teacher or articulated by the students. This depends on the students' readiness level and the teacher's ability to facilitate the SDL activity, which inevitably is tied to the phases of self-direction. For example, at lower degrees of self-direction, the teacher makes decisions about the learning outcomes of the lesson. At a point when the teacher feels that students may be able to articulate their individual learning outcomes, he or she can provide support in helping the students to sharpen or narrow down their desired learning outcomes.

At higher degrees of self-direction, the teacher allows his or her students to articulate their learning outcomes based on a topic, concept or task that needs to be completed (these may be dictated by the teacher, the students or both, depending on the readiness for self-direction exhibited by the students). At this phase of readiness, students and teachers will discuss and negotiate the learning outcomes. The students' role is to identify what they want to learn. The teachers' role is to validate the students' learning goals or stretch their potential by guiding them towards what they should be learning. Teachers and students may want to self-assess their readiness level prior to the lesson (see Chapter 4).

Some of possible questions that a teacher can ask himself or herself when the students are at a low degree of self-direction include:

- What is the learning outcome of this activity?

- What is the specific instructional objective for this activity? (‘instructional objective’ here refers to content related objective, e.g concepts that students have to learn, knowledge they have to acquire)
- What do I want my students to achieve or exhibit?
- Do I want my students to be able to work in groups?
- Do I want them to be able to be accountable for their work?
- Do I want them to be able to search for information?
- Should they learn how to be discerning when they are sourcing for information?
- Should they be learning a new ICT tool so that they can decide how they want to demonstrate their learning?

The above are some questions that teachers may want to consider when deciding on the learning outcome (both knowledge and processes) which they hope their students will achieve when engaged in SDL activities.

Phases of SDL

From Figure 2, it can be seen that the teacher has to make a decision about the phase of SDL (refer to Figure 1) they want to implement as part of their students’ learning. Again, based on the readiness level of the teacher and students, the level of self-direction will vary. The teacher needs not only implement one phase of SDL. It can be a combination of one or more phases, depending on the learning outcome intended for the activity. Some questions the teacher may ask himself or herself include:

- Which phase(s) of SDL do I want to implement?
- What extent of SDL is suitable for my students?
- What array of activities can I conduct to achieve the desired level of SDL for my students?

Once a teacher has decided on the degree of self-direction, the teacher now will have to design the lesson so that opportunities are created for students to achieve the intended learning outcomes.

Instructional strategies and resources

The design of the lesson is of utmost importance in order for the students to be provided with opportunities to learn and experience various degrees of self-direction. The teacher will have to think through the lesson design, and make various decisions, such as:

(a) Instructional strategies

- How much of direction do I provide my students?
- Should I let them discover on their own or should I provide them with some direction? Do I need to provide them with scaffolds which are highly structured?
- Should I give them specific instructions on how much time they should spend or should I guide my students but let them decide how much time they need or should I allow my students to manage their time on their own?
- Should I manage my students' learning content or should I allow my students to manage their learning and monitor them regularly?
- What tasks can I design to enable the students to apply what they have learnt outside school to school work and vice versa?

(b) Resources

- What current resources can I utilise, including resources from the students?
- What changes do I have to make to my current lesson ideas? Can I adapt my current lesson to include opportunities for my students to be self-directed learners?

- Are my students capable of sourcing for information and other resources independently? Do I give them total independence? Do they need a learning guide or some resources to start them off?
- How much time do I have to conduct this lesson? Which aspects of the lesson do I want to do in class? Which parts of the lesson can be done by my students in their personal time?
- What resources do my students need that may enable them to monitor their own learning while completing the identified tasks?

When designing the instructional strategies and accessing the resources required for the SDL activity, the teacher may need to consider issues related to group formation, such as:

- Should my students work in groups or individually?
- Do they decide the group formation or do I?
- Do they work in class (face-to-face) or do they work online?

Technology integration

Once teachers have decided on the lesson design, they may want to consider the integration of technological tools to enhance students' learning and to assist them in monitoring their students' learning. Key considerations include:

- Is there a place for technology to support my students' SDL? How will it lend support to my students? How can I utilise the technology to scaffold my students' learning?
 - Do I want to implement technology to support my students' brainstorming activity?
 - Do I want to implement technology to support my students' discussion and negotiation processes?
 - Should it be technology that can provide a platform for my students to build up their knowledge as a collaborative group?

- Should it be technology that will provide my students opportunities to demonstrate their learning?
- How can I take advantage of technology to monitor my students' learning?
- What type of technology do I want to integrate? Do I want to integrate what my students have already learnt? Do I want to integrate technology which my students are unfamiliar with but are capable of using it?
- Should I give my students opportunities to choose their preferred technological tool?

The following are some technological tools which can be used for various purposes depending on the teachers' intention.

(a) Mind maps can be used for:

- problem solving
- creating outlines for planning purposes
- brainstorming ideas
- expressing individual understanding of concepts learnt

(b) Forum Discussions serve as a platform:

- to continue discussions out of the classroom
- to share information about a concept or topic which students have to learn
- to discuss issues before coming to class
- to generate ideas and share resources
- to provide support groups to one other as they explore new concepts
- for teachers to monitor students' understanding of concepts which they are required to learn
- for teachers to monitor the thought processes or thinking processes in a group discussion

(c) Wiki platforms are useful when

- students are required to build on one another's contributions
- students can edit and consolidate one another's contributions in a neat and organized fashion
- the wiki page can be organized into various sites for easy reference
- wiki pages can be an ongoing task for students to share their learning journey

(d) Blogs are useful when teachers want their students to:

- share their opinions about a topic
- reflect on what they have learnt
- share their experiences

The questions we pose in this chapter are not meant to be exhaustive. They serve as triggers for the skilful teacher as he or she plans for SDL to happen within the context of formal schooling. In the next chapter, we illustrate how these design principles are put into practice when a teacher plans for SDL to take place with particular attention on the use of ICT.

3

Worked Examples of SDL

Introduction

In chapter 2, we laid out the SDL spectrum as a way for teachers to negotiate the extent of SDL that is possible for their students. We also made explicit the design principles that have to be judiciously considered when planning for SDL to take place in the classroom or other learning environments. In this chapter, we provide worked examples of how SDL may look like in the classroom or other learning environments. We foreground the learning outcomes, the learning scenarios and the possible uses of ICT in our examples. Each scenario is organized according to Gibbons' (2002) SDL spectrum (see Chapter 2), starting from the incidental SDL.

Design Considerations for Incidental Self-Directed Learning

The scenarios depicted here are mainly teacher-directed. For each scenario, we provide a counter-example of SDL and how it can be redesigned to provide opportunities for SDL to take place. The following assumption has been made in crafting the scenarios: directions for learning are decided by the teacher. Much of the decisions about how to learn, what to learn and how to exhibit learning are decided by the teacher for the students.

Learning outcomes (for Scenarios 1 & 2)

What are the learning outcomes the students should achieve by the end of this learning process?

- *Instead of being provided with the information, students are given the opportunity to inter-connect related concepts and issues.*

Scenario 1:

What a non “incidental self-directed learning” lesson may look like

Mrs Lim wants her students to differentiate between living and non-living things. Through a didactic manner of teaching, Mrs Lim presents the information via a PowerPoint presentation. She presents information on the characteristics of living things, namely: feeding, movement, breathing, excretion, growth, sensitivity and reproduction. Mrs Lim then shows pictures of living things like animals and plants as well as non-living things like cars, books, and toys. Through nominated response, she asks her students to choose any 4 pictures presented and group them into living and non-living things.

Redesigned Scenario 1:

What an “incidental self-directed learning” lesson may look like

Mrs Lim begins the lesson by showing animated pictures of a dog and a car using PowerPoint. She poses questions to make her students think. She provides opportunities for them to ask her questions about the two pictures related to the characteristics of living and non-living things. If students do not take the opportunity to ask questions, Mrs. Lim may elicit responses from them by making them think. For example, she asks:

- *What are the similarities and differences between these two things?*
- *One of the characteristics of a dog is that it can move. Since the car can move just like a dog, does it mean that the car is a living thing?*
- *So why a dog is classified as a living thing and the car a non-living thing?*
- *What are the other possible characteristics that help us decide one is a living and the other is a non-living thing?*

After having going through more examples, Mrs. Lim asks her students to draw a mind map of their understanding of living and non-living things. She asks them to add questions if they are unsure. Students will complete the mind map. After going through her students' mind maps, Mrs. Lim can consolidate their doubts and clarify in the next lesson.

Possible uses of technology for the redesigned Scenario 1

Teacher uses technology like PowerPoint and online teaching materials from the Internet to present facts about the characteristics of living things and non-living things. This provides opportunities for students to visualize and make comparisons and infer the characteristics of living and non-living things. The teacher also provides opportunities for students to consolidate their understanding through the use of mind maps.

Scenario 2:

How non “incidental self-directed learning” may look like in the classroom

Miss Kala informs the class that they are going to learn about the various ways to represent data, such as in the form of pie chart, histograms and bar charts. She shows her students the various graphs via PowerPoint and queries which graphical form they should use for their lesson on that day. Majority of the students choose the pie chart. Using the pie chart as an example, she explains that the pie chart is a great way of showing the different segments through colour codes. Pie chart is also useful for visualising the various percentage distributions as a whole. Miss Kala highlights to her students that often, they will see a segment of the drawing separated from the rest of the pie in order to emphasize an important piece of information. A student, Joseph, asks Miss Kala how a pie chart differs from a bar graph. Miss Kala then shows the class her prepared PowerPoint slides on the bar graph and verbally explains the key points about the bar graph.

Redesigned Scenario 2:

How incidental self-directed learning may look like in the classroom

Ms Kala informs her students that data can be represented in various forms. Ms Kala shows some examples how data is collected, collated, analysed and represented, such as using the pie chart, bar graph and histogram. She then gives her students twenty minutes to search the Internet on ways of representing data and the usefulness of each graphical form. Depending on the ability of her students to work independently, Miss Kala might give them keywords to begin their search, or specific websites for them to look for information or give them complete choice of where they want to source for

the relevant information. She instructs her students to discuss in groups to consolidate what they have found out from their searches. Each group is given a Wiki page to share the outcome of their group discussion.

Possible uses of technology for the redesigned Scenario 2

The use of internet allows for students to source for information and make decisions about relevance of information selected. Depending on the ability of the students to search for information, the use of internet provides for much flexibility as to where students locate information. The teacher has decided to use Wiki to support her students' discussion. She can do so by creating a Wiki page for each student group. In each group page, the teacher can scaffold their discussion by adding pictures of various graphs. Students are required to respond with their reasons as to why they will use a particular graph. The use of Wiki enables the teacher to monitor students' responses and to check for their understanding on the appropriate use of graphs to represent data. In addition, the use of Wiki as a platform allows students to consolidate their learning and to share their findings within their group to help build on each other's contributions. Each student group page can be made available to other groups in the class, so that they can learn from one another. Besides the Wiki pages, teachers could also use Google docs since the platform allows group collaboration and access by various group members.

Design Considerations for Teaching Students to Think Independently

The scenarios depicted in this section emphasise the skills students need as they are given more opportunities to direct their learning. When designing a lesson, a teacher might consider:

- providing opportunities for students to communicate with friends and the teacher face to face and/or online
- making provisions for handling real life data for an identified purpose
- designing tasks to develop multiple perspectives to an issue and reach a common consensus for the task at hand

Learning outcomes (for Scenarios 3 & 4)

What are the learning outcomes that the students should achieve by the end of this learning process?

- *Students should be able to take the initiative to ask questions related to the topic of discussion*
- *Students should be able to conduct inquiry and investigate their areas of interest*
- *Based on their findings, students should be able to present their opinions or derive a feasible conclusion verbally and/or using other modalities*

Scenario 3:

A counter-example of “teaching students to think independently”

Mr Lim provides his students with data collected from some real world contexts. The use of real data enables the students to link what they are learning in class to the real world outside. He shows the students how the data is presented in graphical forms. He gives his students some questions to answer that test their ability to analyse the graphs in the form of a group work. The teacher walks around the class to answer any queries that may arise during the group discussions.

Redesigned Scenario 3:

How a “teaching students to think independently” lesson may look like

Mr Lim prepares instructions and informs students that they will have to collect data for the Mathematics lesson next week on ‘Graphs’. This is Mr Lim’s effort in providing opportunities for his students to experience how to collect their own data. He informs them that it should be an area of interest to them, such as finding out young people’s responses about a new mall in their neighbourhood. The use of real data links classroom learning to real world context and students actually learn by doing – collecting data that they want to analyse on their own, analysing and representing it. The task for students is to analyse the data and present their findings using the graph they feel best represents what they want to find out.

Unlike the usual lesson where students look at the final graph and analyse it like a worksheet, students are now experiencing how data is collected, collated, analysed and represented. They will have questions to ask, such as how to consolidate the data they have collected using Microsoft Excel. They can approach the teachers to clarify any doubts that they have, such as when they have difficulties creating the graphs technically using Microsoft Excel.

Once they have created the graphs, they will have to rationalize their choice of graph and its suitability for representing the data they have analysed. At this stage, students can be given opportunities to discuss online. They can search websites Mr. Lim has provided for them. Alternatively, if his class is independent, Mr. Lim might suggest keywords for them to search online and to source for their information. Mr. Lim may be able to intervene by modelling for them the kinds of questions and issues they need to consider. For instance, Mr. Lim may question the relevance and credibility of the information the students have found from the Internet. During the online discussions, the teacher assigns roles among the group members so that multiple perspectives are made possible. It is more likely that the students will argue their point of view for issues like which graph is suitable and their reasons for their preferred choice. The roles are explicit so that the students are given the opportunities to question one another's assumptions before reaching a consensus. They are explicitly instructed to agree to disagree as their rule of engagement but at the end of the discussion, they will have to negotiate and reach a consensus as a group.

Beyond the content learning outcome, students in this scenario learn soft skills. They learn to present their argument, to substantiate their argument or point of view with reasons or facts. They learn to question each other's point of view. Students are provided opportunities to communicate with each other and to share their points of view. They are provided opportunities to negotiate and reach a consensus. These are skills and experiences that students gain because Mr. Lim, the teacher, has decided to provide opportunities for his students to think independently.

Possible uses of technology in the redesigned Scenario 3

Students use the Excel spreadsheet to collate and organise their data. The data can be represented in various forms. With the use of technology, students can visualize how their data will look like through the use of the various graphs.

Forums are useful for the students to work on their data collaboratively over a period of time. It is appropriate for them to discuss and share their findings. Some possible benefits are that students can conduct research on their own and share their findings with the peers within the group. They can further discuss about the pros and cons of the various types of graphs and the usefulness of using the various types of representations. The forum discussion serves as a platform for students to share their thoughts and ideas, question one other's assumptions and to explore and gather information beyond the text. The forum discussion is also useful for Mr. Lim to monitor his students' understanding of the topic of investigation. Mr. Lim can guide his students if they are unable to make decisions. Mr. Lim can also monitor his students' progress. When necessary, he can clarify students' doubts and help them to move forward in their learning.

The teacher's roles in the redesigned Scenario 3

Mr. Lim's role is to essentially set tasks with clear instructions and milestones for his students. Mr. Lim will have to facilitate and monitor students' progress, both in the face-to-face and online modes. Depending on the readiness to participate in group work, Mr. Lim may permit some students to form groups or give some students clear guidelines on how they can form their own groups.

When using technology, Mr. Lim may have to demonstrate the technical skills required. For example when using the spreadsheet, Mr. Lim might have to demonstrate how data entry should be done. This may be taught just-in-time when the students ask questions about keying in and analysing the data they have collected using Microsoft Excel. Alternatively, Mr. Lim might engage student helpers to assist in demonstrating to their peers how data entry can be done.

When setting up online discussions, Mr. Lim needs to state clearly the rules for

engagement, such as the discussion format and the etiquette for participating in the discussion. Mr. Lim's role in the forum discussion is to monitor his students' discussion, observe the learning that is taking place, and to answer any queries that his students may have so they can make progress in their learning. Modelling by the teacher takes place here as well as a way to teach the students how to think independently in group work with regard to their levels of thinking, the choices they make, the relevance and credibility of the information they have sourced, and how to engage in argumentative thinking that is constructive for group work.

The students' roles in the redesigned Scenario 3

Given the opportunity to explore ways of representing their understanding (such as by creating graphs), the students learn how to consolidate, organise, and present their data graphically. They also learn to rationalise the best way to represent their understanding as a group, such as when they are selecting the most appropriate graph for their group task. The students also learn to be resourceful as they explore the various graphs that are available for their use. They also learn to be effective in their search through the guidelines the teacher provides during the search itself and learn to evaluate the various sources of information as a group. The students take responsibility to reach a consensus and learn how best to present their findings to the class or the teacher.

Scenario 4:

A counter-example of "teaching students to think independently"

Mdm Rohana sets a task for her students to research about a current or past world leader. The students' task is to investigate and research about the leader, the characteristics of the world leader, the actions of the leader and the impact of the actions and how people perceive the world leader. The students then present their findings in the form of a talk show. Each member is to take on a role: A reporter, the world leader, an aide to the world leader, one or two member(s) of the public, preferably of different social economic status. The students will have to source for sufficient information to play the various roles and during the talk show, they are to share the information with their classmates and to rationalise

why they feel this leader is their role model. The students finally do a report writing task on the leader identified for their research topic.

Redesigned Scenario 4:

How a “teaching students to think independently” lesson may look like

Mdm Rohana asks her students for examples of world leaders they know from their textbook, news and elsewhere. She leads a class discussion on what makes a person a world leader and collectively with the class, she teases out criteria for assessing leadership, such as the characteristics of the world leader, their actions and the impact of their actions on the world, and the perceptions of the public of them.

Mdm Rohana asks each group of students to choose a world leader based on the class discussion and find out more information about the leader the group has chosen to research on. Mdm Rohana assigns specific roles for each group, the tasks to be completed within a specified time frame. Each group has to report to her the decisions they have to make, such as the responsibilities of each group member according to the roles given and their reasons for the choice of the world leader. Students are also told to gather their information and build up their Wiki page on the world leader whom they have chosen.

Mdm Rohana provides questions to guide her students in their fact finding and poses questions that further their thinking so that her students can constantly build their understanding using the Wiki. Once the information has been built up on the Wiki, students will have discuss to extract relevant information they want to share or present during the ‘talk show’ where they will share their findings with their classmates. Students will also consolidate the resources and information using any presentation tools to complement their talk show.

Possible uses of technology in the redesigned Scenario 4

Mdm Rohana makes use of Internet resources to expand students’ knowledge about the selected world leaders. In addition, the Wiki is created to guide students’ meaning making process as they read and assimilate what they know

about the world leaders. The Wiki is also used to share and build students' knowledge during this process. Finally, the Wiki serves as a resource page for each group and the entire class, not just to develop their talk show, but also as another learning material about the world leaders. In addition, the Wiki page serves as a platform for Mdm Rohana to monitor and track the development of thoughts and knowledge about the world leaders among the students. Mdm Rohana may suggest the use of Glogster to present the key information in creative manner to the rest of the classmates.

The teacher's role in the redesigned Scenario 4

Similar to Scenario 1, Mdm Rohana's role is to set tasks with clear instructions and milestones for her students. Mdm Rohana may have to start the lesson by making available some resources for classroom teaching, such as a list of start-up websites for classroom discussions and a follow-up Internet search. Mdm Rohana may provide some guidelines on how her students should participate in group discussion for each specified role. For example, she may ask a student to play the role of a devil's advocate. The student adopting this role may ask questions like: I like your reasons but have you searched websites that present the world leader in a negative manner? Based on knowledge of her students' participation in group work, Mdm Rohana may assign students to a particular group or allow them to form their own groups. When the students are ready, Mdm Rohana gives them permission to begin their research and add relevant information on their Wiki page.

If students need further guidance or resources, the Mdm Rohana may then provide them with the necessary resources or to point them to where they can obtain the required information. Mdm Rohana might also ask questions to help each group monitor the development of their thoughts and knowledge in the Wiki page to ensure that they have collected substantial information to present during the talk show.

The students' role in the redesigned Scenario 4

Since students have to select a world leader to research on, they will have to come to a decision based on a consensus reached among the group members. The decision making process may take various forms. One possible way is where students in a group brainstorm and select a world leader based on the most convincing reason and popular vote. Another approach could be that students start with research on various world leaders and propose their selection to the rest of the group members and convince them that their selection should be picked. This is where students are likely to question, explore, investigate and argue more about their point of view. It provides opportunities for students to develop independent thinking and decision making skills.

Once the group has decided on the world leader, they will then have to negotiate and decide who takes on the various characters – reporter, world leader etc. Some groups may decide that they will conduct their research based on the different requirements set by the teacher and once they have the information, they will then work out the roles. Again, students will have to decide and work out how best they want to learn.

Students then discuss and think of the best way to present their choice of the world leader and the rationale for their choice. They will also have to think about what information they will want to add on to their presentation tool (Glogster, PowerPoint, etc) to complement their role play and to succinctly bring the important points across to their classmates.

During role play, other students can be prompted to ask questions, to seek clarification and to challenge assumptions made by the groups. After having gathered the various view points, students will now have a better insight to the information they have gathered. They will then take on the persona of any of the characters and write a report.

Design Principles for Self-Managed Learning

The design considerations that teachers should factor in would be to reflect on their roles. The teacher may want to adopt the role of a facilitator to provide guidance, feedback and direction for the students to add value to their learning. The teacher does not teach the students what they do not know; the teacher highlights the areas that students should focus on and guides them through the learning process.

The following is an example of how a 'self-managed learning' lesson may be designed.

Learning Outcomes

What are the learning outcomes that the students should achieve by the end of this learning process?

- *Students are given opportunities to select what they want to learn*
- *Students pace their learning*
- *If students are unsure, they are able to re-visit the concepts and learn them at their own pace*
- *Students may seek assistance from the teacher should they need to*
- *Once students are confident of the concepts, they can opt to self-assess their learning*
- *Assessment could also be conducted by the teacher*

Scenario 5: How self-managed learning may look like in the classroom

Mr Gabriel selects an article on global warming to generate interest among his students. He gives them the following article to read...

Global Warming... what is it all about?

"An island of ice more than four times the size of Manhattan is drifting across the Arctic Ocean after breaking off a glacier in Greenland.

In a July 6, 2009 photo made available by Greenpeace, researcher Jason Box adjusts a time-lapse camera on the southeast side of Petermann Glacier, one of Greenland's largest and most northerly glaciers. A 100-square-mile iceberg

broke off the glacier last week.

Satellite images from NASA show the Petermann Glacier on July 28 (left photo) and after the ice sheet broke free on Aug. 5. "It's so big that you can't prevent it from drifting. You can't stop it," says Jon-Ove Methlie Hagen, a glaciologist at the University of Oslo.

Potentially in the path of this unstoppable giant are oil platforms and shipping lanes - and any collision could do untold damage. In a worst-case scenario, large chunks could reach the heavily trafficked waters where another Greenland iceberg sank the Titanic in 1912.

It's been a summer of near biblical climatic havoc across the planet, with wildfires, heat and smog in Russia and killer floods in Asia. But the moment the Petermann Glacier cracked last week – creating the biggest Arctic ice island in half a century – may symbolize a warming world like no other”

Source of article:

http://www.pressherald.com/news/nationworld/giant-iceberg-fuels-debate-over-global-warming_2010-08-11.html

Mr Gabriel informs his students that there is renewed interest in global warming given the current issue of the breakaway iceberg. In order to prepare for class discussions, he asks them to read a lesson package he has created for them on the Learning Management System. He informs them that they have one week to complete their task. He reminds them to attempt the quiz he has designed for them at the end of each segment. The objective of the quiz is to help his students to test their understanding of the topics which they have just gone through. He reiterates that if they do not perform well for the quiz, the students are allowed to re-visit the information and to attempt the quiz again. He reminds them to attempt all the quizzes and to submit their responses so that he can assess how prepared his students are for the class discussion.

An alternative approach to this scenario could be that Mr Gabriel generates interest in the topic of global warming to get his students' attention. He then gives them broad areas to focus on and he reminds them that they have one week to search for the relevant information so that they are prepared to

participate actively in class discussion the following week. In order to get them started, Mr Gabriel posts some web resources and information for his students. He expects them to research beyond the information that he has provided and to chart their learning. Mr Gabriel might choose to monitor his students' progress by requesting them to post their findings on a forum discussion board or a blog.

The teacher's role in Scenario 5

Mr. Gabriel's role could vary depending on his assessment of the ability of his students to learn independently. If Mr. Gabriel assesses that his students need pre-packaged materials to get them started, then his role as a teacher would be to gather the relevant information and present the resources to his students so they can explore. If he feels that his students' potential can be stretched beyond the information he has consolidated, he might suggest to them that they can explore resources beyond what he has given.

In a different scenario, Mr. Gabriel might assess that his students are independent and will be able to research on the topics without his consolidated resources. In this situation, Mr. Gabriel will provide broad guidelines for his students so they know what research they should be engaged in. They will then source for the relevant information and learn what they have to in order to be prepared for the class discussion.

The students' role in Scenario 5

The students are required to assess their own knowledge of the topic. Directed by the resources that Mr. Gabriel has consolidated for them, students will access the information that they feel they do not know well and learn it. They may do self-assessment by attempting the quiz. If they do well, they may then proceed to another area where they feel they need to gather knowledge. Essentially, the students' role is to reflect on what they do not know, and to learn it so that they are prepared for the task that they have to attempt.

Self-planned and Self-directed learning

In self-planned and self-directed learning, students are ready to assume high degree of self-direction. Students are required to make decisions about what they want to learn, how they want to learn, and to draw out a time frame of the duration within which they will achieve what they want to learn. Some possible areas where teachers may attempt to introduce self-planned and self-directed learning may be in the area of project work.

Scenario 6

Instead of providing his students with topics for their project work (which Mr. Tan usually does), he has decided that he wants his students to take responsibility for their work and to be motivated to complete it. Mr. Tan's decision is made on the basis that he wants his students to learn what they want to when they are engaged in project work.

He informs students that they will have to submit a project, together with a portfolio of the progress they made in their learning to him in 6 months' time. He tells them to make decisions and to consult him on how they would like to approach the project.

During the consultation, Mr. Tan expects his students to inform him of the following:

- *The group members whom they will be working with*
- *The topic of their choice and why*
- *The timeline for their project, together with major milestones where they will submit artefacts to him reflecting their progress*
- *The directions in how they will learn and complete the project*
- *The choice of presentation mode they will use to showcase their learning*

Mr. Tan reminds students that they are responsible for generating their learning objectives and charting the timeline. He reiterates that it is the students' responsibility to update him on their progress and to consult him when they need

assistance. To assist his students' learning process and to monitor their learning, Mr. Tan may create an e-portfolio within the Learning Management System. His students could use the e-portfolio to present their progress to Mr. Tan and to reflect on their own learning. The e-portfolio serves as a means for students to chart their progress and to reflect on whether they have achieved the learning goals they had set for themselves.

In this chapter, we have attempted to describe how the different scales of self-directed learning may look like in a lesson. The examples given are not exhaustive. They are just some examples of how a lesson might look like based on the design considerations that teachers may have in mind. The lessons may vary depending on many factors, such as students' readiness to work independently, teacher's assessment of students' learning needs, availability of resources, and availability of technology to support students' learning. To reiterate, the teacher's role is crucial in the design process of the lesson since the teacher has to articulate the learning goal which the students need to achieve.

4

Assessment and SDL

Types of Assessments in SDL

In chapter 3, we illustrated how SDL may take place to differing extents within formal schooling in Singapore. In this chapter, we consider how teachers may assess SDL to enhance students' learning. We first describe ways of developing students' capacity in self-assessment followed by the types of assessment a teacher can use in the process of guiding students for SDL.

As educators, we recognise the importance of assessment in learning. We are familiar with assessment of learning, also known as summative assessment (Bloom, Hastings, & Madaus, 1971) that evaluates the extent to which learning goals are achieved, usually in the forms of quiz, test, or examination. We commonly use information from assessment of learning for placement purpose. For example in Singapore, our primary school pupils apply to different types of secondary schools based on their Primary School Leaving Examination (PSLE) scores, or pupils are placed in different classes based on their overall yearly performance in the school examinations. Assessment of learning is also used for to gauge the effectiveness of an individual or a school in achieving specific educational outcomes.

Consistent with the goals of self-directed learning, we should focus on assessment for learning as opposed to assessment of learning. Assessment for learning (Black & Wiliam, 1998) is the use of assessment to improve learning, both in terms of the learning outcomes and the learning processes. For example,

a teacher analyses her students' performance in a class test to diagnose the common problems or misconceptions associated with learning a particular topic. Using this information, the teacher then designs subsequent lessons to help her students overcome the problems to achieve better understanding of the topic. For self-directed learning, a teacher assesses her students' behaviours that indicate self-direction so that she can provide feedback to the students or to modify her instructional strategies. Moving one step closer to the goal of self-directed learning, it is desirable to develop students' capacity in self-assessment so that they can assess their own progress and make appropriate changes. In this way, assessment becomes an integral part of the learning process.

Developing Students' Capacity in Self-Assessment

Below is a vignette of what happened in a Primary 3 English class:

Vignette of a Primary 3 English class

The pupils are tasked as a tour guide to introduce a famous river to the tourists. They work in groups of five. In this particular lesson, the pupils use the Internet to search for information for their presentation. Examine this excerpt of conversation amongst a group of three Primary Three pupils (aged nine) when they are searching for information on the River Nile. Their task is to assume the role of a tour guide to introduce the River Nile to a group of tourists.

Jeremy: Hey, I found this website. Look, there are many pictures.

Joel: Wow, quick, right click and save the pictures.

Janet: Yes, yes, and paste them in the PowerPoint.

Jeremy: All the pictures?

Joel: Click this one. I like crocodiles... the birds look nice also.

Jeremy: OK, ok, what should I type in the PowerPoint?

Janet: Here, copy this part. "The River Nile, is the longest river in the world. Every year the Nile floods at almost exactly the same time of year, 15th July."

Jeremy: OK, what else can we include? The teacher said we need to present for 2 minutes.

From the children's conversation, we can tell one possible reason for not engaging effectively in SDL among the children is that they do not know the criteria of a good performance. In this case, the children do not know what they can include in their presentation to excite the tourists as a tour guide. Joel's criterion for selecting the picture is based on his personal preference. Janet suggests copying the text without checking whether it is relevant to the task. They probably do not realise that they need to appeal to the tourists' interests or arouse their curiosity.

When we are learning a physical skill, the feedback is usually concrete and observable. For example, you will know whether you have learnt how to cycle because you will experience the success (the bicycle move forward while you maintain your balance) or failure (you fall). When learning a cognitive skill or knowledge, the criteria to assess whether we are successful are not intuitive or observable. As a teacher, it is necessary to devote an appropriate amount of time and effort to develop in students the capacity to assess their own learning.

Different levels of scaffolds can also be provided for this purpose. For lower primary pupils, a checklist with observable indicators can be used. For upper primary pupils, assessment rubrics with an explanation and demonstration on how to use the rubrics can be considered. For secondary school or older students, they can be encouraged to identify and discuss the appropriate assessment criteria for their assigned tasks. The following section shows examples of how students can self-assess their self-directed learning.

Students' Self-Assessment of SDL

Table 2 shows an example of a students' self-assessment template. It uses a 6-point Likert scale. A classroom teacher can ask his or her students to decide on

the extent to which they are engaged in a SDL behaviour by shading the appropriate circle using intuitive judgement whether it is closer to the descriptor “All the time” or “Not at all”. If your students have problems understanding the scale, you can change the 6-point scale to Yes/No options.

Depending on the readiness of your students (see Chapter 2), it may be necessary to go through the form with the students to help them understand the statements. For younger pupils, the items may be changed to suit their comprehension level by using smiley icons (e.g. 😊, 😐, ☹️) to replace the circles. This can be followed by a discussion with the students on ways they can improve. Help them to analyse what could have prevented them from engaging in SDL. Is it because they are not aware of it or they do not know how? If they do not have the competency, where can they turn to for help? Students who are more ready for SDL could do the self-assessment independently to monitor their own progress.

The statements are general indicators that may probably change only after a few weeks or months of intervention. Table 2 is best used to gauge and record the general behaviours at different points in a semester (rather than daily or weekly) or for a project that lasts for at least a few weeks.

Table 2: Students' self-assessment of SDL behaviours

Behavioural Indicators	Frequency						Reflection	
	Not at all			All the time			I am satisfied with my performance	I can improve by...
• I set learning targets for myself.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Yes <input type="radio"/> No	
• I know which parts of my lessons I do not understand.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Yes <input type="radio"/> No	
• I ask questions when I am not sure about my lessons.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Yes <input type="radio"/> No	
• I look for more information to help me understand my lessons better.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Yes <input type="radio"/> No	
• I make a list of what I need to do for my learning.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Yes <input type="radio"/> No	
• I complete my schoolwork on time.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Yes <input type="radio"/> No	
• I try to understand where I went wrong in my schoolwork.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Yes <input type="radio"/> No	
• I try different ways to solve problems on my own.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Yes <input type="radio"/> No	
• I use what I learn in class after my lessons.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Yes <input type="radio"/> No	
• I find out more than what my teacher teaches me in school.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> Yes <input type="radio"/> No	

Students' Self-Assessment of Performance Outcomes

Previously, we focused on how to facilitate students' self-assessment of their participation in SDL processes. We now move on to discuss ways of using rubrics to develop students' capacity in assessing performance tasks for SDL.

In essence, assessment rubrics are used for authentic performance tasks that are complex, involving multi-dimensional skills, and require judgment to grade the performance. For example, to complete a science investigation project, students have to formulate the problem, collect data, analyse the data, and write the report. Each of these processes involves several skills. Using a rubric, we can clarify the different dimensions of assessment, and descriptors of different levels of performance. Table 3 shows an example of a rubric for science project for Secondary school level.

When using rubrics, it is important to explain the different dimensions of performance (such as information seeking skills) and the level of achievement (such as extents of meeting expectations). A checklist (with Yes/No options rather than level of performance) can also be used for younger students who might have problems understanding rubrics. Spaces can also be provided for the students to score their performance, justify their assessment and suggest areas for improvement. It is important to impress upon the students that the purpose is not to prove how good they are, but to reflect on their performance for improvement.

Classroom teachers can also conduct conferences with students using their self-assessment. The conference provides an opportunity for the teachers to validate their students' self-assessment and help them to develop their self assessment skills. Depending on the maturity level of the students, they can also use it for peer assessment.

Table 3: An example of an assessment rubric for a science project

Components of project	Beginning	Developing	Accomplished	Exemplary	Student's comments	Teacher's or peer's comments
Choice of research problem and questions	Use research questions supplied by reference books or other sources	Construct research questions that have readily available answers	Construct research questions that are challenging	Construct challenging research questions and justify the significance of the study		
Information seeking	Gather information that lacks relevance	Gather relevant information from one or two sources, lacks depth and quality	Gather relevant information from a variety of sources, select sources with depth and quality	Gather relevant information from a variety of sources with depth and quality; critically synthesise ideas to support the research		
Data collection method	Data collected are not relevant to the research questions	Relevant data but lack of precision or reliability	Relevant data that demonstrates precision and reliability	Relevant, precise and reliable data, with valid assessment on the quality of data.		
Analysis	Present raw data	Attempt to analyse the data	Use scientific method to analyse the data	Use scientific method to analyse the data and justify for the appropriateness of method		
Report/ Presentation	The report is not logically presented	Use standard scientific format to present	Present a coherent scientific report with clear focus on the investigation	Present a scientific report that is clear, concise, and convincing. Use evidence to support the conclusion		
Communication	Use layman language	Attempt to use scientific language with some errors	Use scientific language accurately to present the findings	Use scientific language effectively to present the findings in a logical manner		

Perhaps the highest level of self-direction is achieved when students can develop their own assessment rubrics, explain their rationales and use them objectively to monitor their own learning. This can only happen when a student appreciates the complexity of a task, understand what it entails, and sets high standards for himself or herself.

Students' Portfolio

A student's portfolio contains a purposeful selection of works by the student together with the reflection for learning. There are many resources available on the uses and ways to prepare a portfolio. Unfortunately, the diverse applications of portfolio also bring about some confusion. We will focus on how portfolio assessment can be used for SDL. When used appropriately, it is an ideal tool for assessment for learning.

For learning purposes, a portfolio should not be a mandatory collection of specified works from a program or a course that is like a student's dossier or folder, which at best provides additional evidence for the teacher to assess the learning outcomes. It is also important to distinguish learning portfolio from showcase portfolio. While a learning portfolio focuses on assessment for learning, a showcase portfolio usually contains the student's best works and is used as a summative proof for the learning outcomes or for gaining entry into a new programme. For SDL, students should assume some responsibilities in identifying and explaining the choice of works that represent their learning progress or development. Asking students to choose and justify for their selection will likely engage them in self-managing and self-monitoring of learning. They have to think about which piece of work fulfils the specified criteria and will reflect on the quality of work. Inevitably, reflection becomes a critical part of the portfolio assessment.

There are different levels of reflection in a portfolio assessment. A student may write about the overall structure and choice of works that will fulfil the learning criteria; a reflection on the overall learning progress and areas for improvement; a self-assessment on a particular aspect of learning (e.g., communication skills); or a comment on a particular piece of work. To engage in meaningful reflection, the purpose of reflection and the criteria for assessment must be made known to the students. Student's self-profiling tools and assessment rubrics, as discussed in the previous two sections, can be provided to guide the students in the reflection. For students who are ready, they can develop their own assessment criteria.

As students are at different readiness levels for SDL, a purposeful conference with the teacher about the learning progress using the portfolio will be beneficial. To be effective, the conference can be scheduled early enough for students to receive feedback and work towards improvement. It should also be conducted at appropriate intervals (rather than just at the end of a course) for developmental purposes.

Figure 3 shows the key processes for preparing a learning portfolio. The dotted square boxes describe examples of how a teacher can provide necessary supports throughout the process. As assessment for learning, the learning portfolio enables the students to exhibit what they have learnt developmentally on a continuous basis and can be used to set future direction for learning.

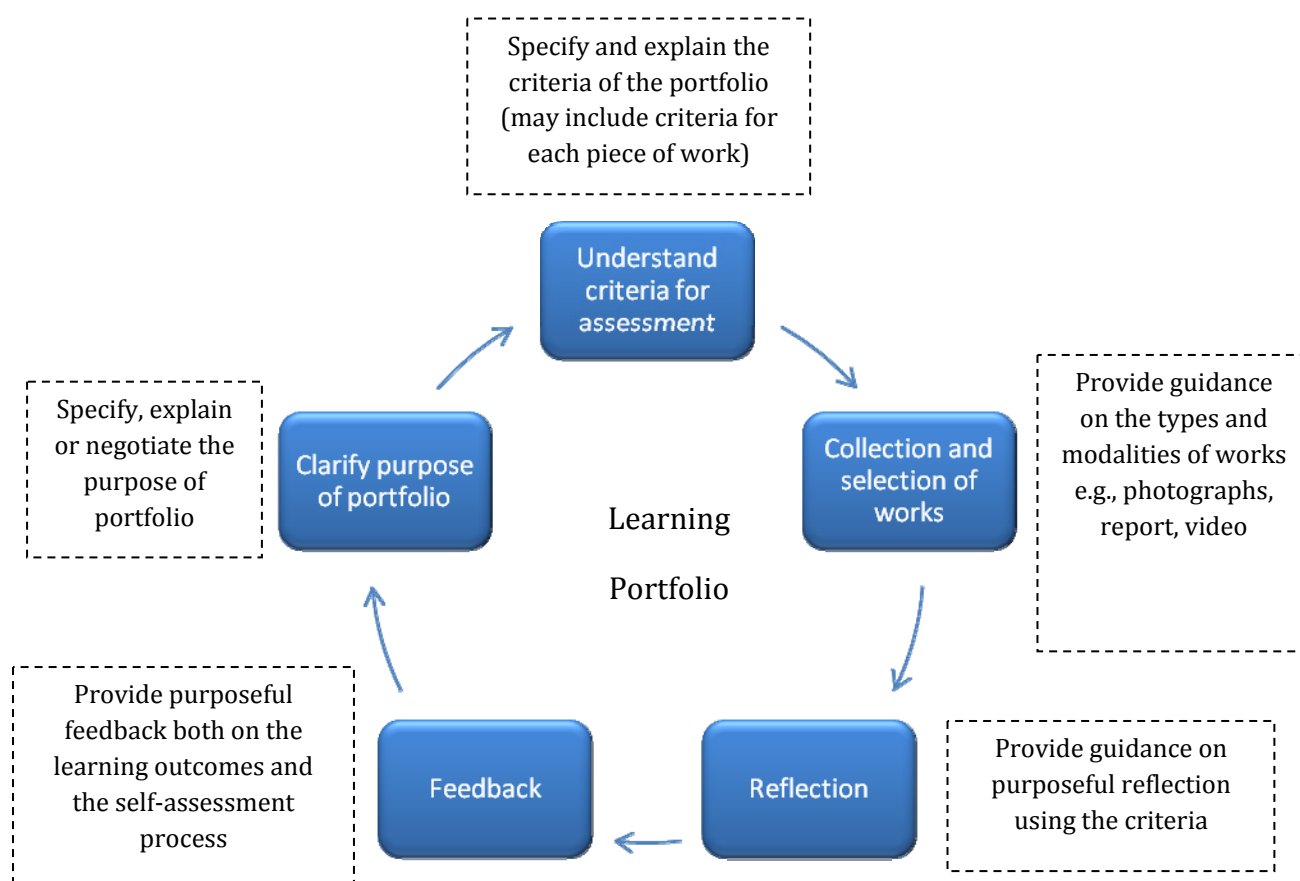


Figure 3: Key processes of a learning portfolio

Teachers' assessment in SDL

Earlier, we focused on how students could assess their SDL. We now move on to discuss how teachers can go about assessing their students' SDL. Classroom teachers can assess whether their students participate in SDL. If the frequency is lower than expected, there are at least two possible follow-up actions that can be taken. One is to further develop students' competency in SDL; the other is to provide more opportunities for students to practice their SDL skills.

Assessing students' behaviours

To assess whether the students practise SDL, one of the ways is to observe their actions and behaviours. Based on the theories of SDL, the three dimensions of SDL i.e. ownership of learning, self-management and self-monitoring and extensions of learning are identified together with corresponding behavioural indicators (see Chapter 1). The extent to which the students display these

behaviours reflects whether the students have developed some generic SDL skills.

Table 4 shows an example of how classroom teachers can rate their students' behaviours. This table uses a 6-point Likert scale. Using a teacher's intuitive judgement, he or she should be able to decide whether it is closer to the descriptors "All the time" or "Not at all". These are general indicators that probably may change after a few weeks or months of intervention. The teacher can use this to gauge and record the general behaviours of a class at different junctures in a semester (rather than daily or weekly) and to make necessary adjustment in his or her instructional strategies.

Table 4: Assessing students' SDL behaviours

Behavioural Indicators	Frequency						Reflection		
	Not at all		All the time				Evidence of lack of learning opportunities	Strategies to provide learning opportunities	How ICT could support the strategies
SDL Dimension 1: Ownership of learning									
• Students identify and articulate their own learning goals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
• Students determine learning goals and identify learning tasks to achieve the goals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
• Students chart their learning process	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
• Students challenge themselves and set the standards for the achievement of their learning goals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			

Behavioural Indicators	Frequency						Reflection		
	Not at all		All the time				Evidence of lack of learning opportunities	Strategies to provide learning opportunities	How ICT could support the strategies
SDL Dimension 2: Management and monitoring of own learning									
• Students explore a range of possibilities and make sound decisions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
• Students formulate questions and generate relevant inquiries	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
• Students self-plan and self-manage their time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
• Students critically reflect on their learning and initiate gathering of feedback from teachers and peers to achieve their learning goal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
SDL Dimension 3: Extension of own learning									
• Students apply what they have learnt to new contexts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
• Students utilize the skills that they have acquired to learn beyond the curriculum content	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			

A caveat is that this instrument uses behavioural indicators, which may not reveal covert thinking. For example, a student can be reflecting on his or her performance but the thoughts may not be captured as writing. Asking students to keep a reflection log or interviewing the students can complement this instrument. If the frequency of behaviour is lower than expected and there is

evidence that it is due to insufficient opportunities for the students to demonstrate their skills, the teacher can then think of ways to provide these opportunities. Another possible reason is that the students need further development in SDL. A teacher can also assess his/her own scaffolding strategies in fostering SDL amongst the students.

Teachers' self-assessment of scaffolding students for SDL

Table 5 is an example of what a teacher can do to reflect on the roles of the teachers in providing support to engage the students in SDL. These are complementary roles in the three salient aspects of SDL.

Table 5: Teachers' self-assessment of scaffolding for SDL

Behavioural Indicators	Frequency						Reflection		
	Not at all		All the time				Evidence that students lack competency	Strategies for enhanced scaffolding	How ICT could support the strategies
Student-teachers learning partnership									
<ul style="list-style-type: none">Teachers negotiate and provide scaffold to students to enable them to develop a learning contract to achieve their intended learning goals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
<ul style="list-style-type: none">Teachers provide support for students to plan and chart their learning path	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
<ul style="list-style-type: none">Teachers provide support for students to develop self-evaluation criteria	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			

Behavioural Indicators	Frequency						Reflection		
	Not at all		All the time				Evidence that students lack competency	Strategies for enhanced scaffolding	How ICT could support the strategies
Conditions for students’ self-management and monitoring of their learning									
<ul style="list-style-type: none">Teachers to identify relevant skills that students need (e.g. goal setting, managing and planning learning, resource management) so as to enable students to become efficient in their learning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
Experiences for extension of students’ learning									
<ul style="list-style-type: none">Teachers provide learning contexts conducive to broaden and deepen students’ learning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
<ul style="list-style-type: none">Teachers initially challenge students and then gradually encourage students to challenge themselves so as to set high standards of achievement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			

The examples we provide in this chapter work well with the design principles that we laid out in Chapter 2. Although there are suggestions on ways of using these rubrics and the learning portfolio, these assessment means are flexible and open to other informed uses by the teachers. For instance, to assess both

students' and teachers' readiness for SDL, Table 4 and 5 can be used before designing a lesson that fosters SDL. Both tables can also be used to review the extents of SDL that have taken place after some initial efforts are made to foster SDL in the classroom. The ways of assessing SDL are by no means exhaustive and definitely needs extended thought when applied to actual practice in Singapore's context. It is our intention that this chapter can expand Singapore teachers' current understanding of assessment and kick start some possible ways of assessing SDL among the students.

Concluding Thoughts

In this monograph, we attend to the notions of SDL that are of relevance to formal schooling within the Singapore context. While SDL could be more likely to take place in informal contexts, particularly outside schools, we focus on how SDL can be fostered within the formal curricula in Singapore. Ideas on SDL demonstrate that it is useful for the students to have the opportunities to own, manage, monitor and reflect upon their learning enterprise. Alongside SDL, other 21st century skills also become the by-product of participating in such a way of learning. When inculcating SDL in our formal schooling, teachers should always bear in mind that the starting point is the learner and respect therefore should be given to the learner autonomy, interests and vision of learning. The learner and his world can be perceived as resources to be leveraged for classroom teaching and learning.

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